DOCUMENT RESUME

ED 351 501 CE 062 269

TITLE	Identification of Emerging Science Competencies in Agriculture. Vocational Education Research.
INSTITUTION	Louisiana State Univ., Baton Rouge. School of Vocational Education.
SPONS AGENCY	Louisiana State Dept. of Education, Baton Rouge. Div. of Vocational Education.
PUB DATE	1 Dec 89
NOTE	60p.
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Agricultural Education; Agricultural Engineering; Agronomy; Animal Husbandry; *Behavioral Objectives; *Curriculum Development; Entomology; High Schools; Job Skills; Pests; *Scientific Concepts; Scientific Research; Soil Science; Technological Advancement; *Vocational Education
IDENTIFIERS	Louisiana

ABSTRACT

A research project identified new and emerging science concepts that should be taught in high school vocational agriculture. Agricultural scientists on an advisory panel identified the emerging science concepts. The majority were in the areas of plant science and animal science. Animal science was completely reorganized with greater emphasis on breeding systems and reproduction. An instructional unit on anatomy and physiology was added; less emphasis was placed on judging, selection, and animal breeds. Plant science was expanded to include reproduction and genetics. Lessons were added in the areas of plant physiology and classification, fertilizer usage, and nonagronomic careers. Science-related topics such as plant nutrition and environmental factors were given greater emphasis. Topics in soil science remained essentially the same. Changes were made to increase the emphasis placed upon the biological and chemical properties of the soil, soil conservation, soil water, factors affecting productivity of the soil, and quality of soil water. In agricultural mechanics, lessons related to tool fitting were removed, and emphasis was placed on why processes occur or machines work more than the mere facts or steps of occurrence. Entomology was made a separate unit of instruction. (The six-page report is followed by the original lists of competencies and the amended competency lists. The five areas of study in the amended lists and lessons are animal science, plant science, soil science, agricultural mechanics, and entomology.) (YLB)

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Vocational Education Research

Identification of Emerging Science Competencies in Agriculture

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IDENTIFICATION OF EMERGING SCIENCE COMPETENCIES IN AGRICULTURE

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Funded by

The State of Louisiana
Department of Education
Office of Vocational Education

Institution Name Louisiana State University

Date December 1, 1989

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FOREWORD

This research report, Identification of Emerging Science Competencies in Agriculture, was produced as a result of a project funded by the Louisiana State Department of Education to Louisiana State University, Baton Rouge, Louisiana. The results of this project were obtained through a cooperative effort among the research staff at Louisiana State University, agricultural scientists at the Louisiana Agricultural Center, agricultural education teacher educators, and high school vocational agriculture teachers.

An extensive review of the state-adopted curriculum guide for the Basic Program of Vocational Agriculture in Louisiana (Bulletin 1690-I, II, & III) was performed by the agricultural science advisory committee to determine science-related agricultural objectives not presently being taught which have application in modern agricultural industry. Through this research effort the necessary information to revise Bulletin 1690, the Basic Curriculum, was obtained.

The results are important to teacher educators, state department personnel and vocational teachers as they seek to improve instruction in vocational education courses within the state.

Wilmer S. Cody
State Superintendent of Education

ACKNOWLEDGEMENTS

This publication represents the cooperative efforts of personnel in the School of Vocational Education at Louisiana State University and the Office of Vocational Education, Louisiana State Department of Education. Several persons contributed significantly to the success of this research project. Project directors were Dr. Jeffery Moss and Dr. Anna Beth Neason. Fred Sanders served as graduate assistant for the project. Thanks are due to Dr. Gary Moore for his assistance and contributions to the initial project. A special note of appreciation is due to Catherine Mitchell for her assistance with the fiscal accounting of the project and to Sherry Earnhart for typing and compiling the final report. Also, appreciation is expressed to the teachers and advisory committee members who provided input in the competency identification process.

Don Wood

Don Wood
Assistant Superintendent
Vocational Education

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IDENTIFICATION OF EMERGING SCIENCE COMPETENCIES IN AGRICULTURE

Agriculture is changing. The old sow - cow - plow concept of agriculture is rapidly fading. The sow is now being genetically engineered, the cow can produce hundreds of calves per year through super ovulation techniques and embryo transplanting, and the plow is controlled by an on-board computer in the tractor. Science is rapidly changing the face of agriculture. During the past ten years much of agriculture has been drastically altered through the discovery and application of new scientific techniques. Even more change can be expected during the next decade.

High school agriculture programs need to incorporate the new and emerging scientific concepts into the curriculum if their graduates are to be prepared for the future. The emerging scientific advancements in agriculture are starting to be noticed by vocational agricultural educators. In five states (Illinois, Missouri, North Carolina, Texas and Louisiana) researchers have taken an inventory of the current science concepts being taught in agriculture. This is a step in the right direction but much more remains to be done. After identifying what science concepts are currently being taught in high school vocational agriculture programs, the next logical step is to determine what additional science concepts and competencies SHOULD be included in secondary agriculture programs to prepare students for the agriculture

of the future. What SHOULD be taught in Louisiana vocational agriculture programs was the subject of this research.

Purpose and Objectives

The purpose of this research activity was to identify new and emerging science concepts that should be taught in vocational agriculture. This was accomplished by going to the people on the cutting edge of new developments in agriculture, the agricultural scientists, to identify current and emerging agriscience practices. Agricultural scientists in the areas of plant science, animal science, agricultural engineering, entomology, and plant pathology identified the new and emerging agricultural science concepts and competencies that should be taught in vocational agriculture in Louisiana.

The primary objective of this project was to upgrade the high school vocational agriculture program in Louisiana by identifying the agriscience content that should be included in the program. The identified agriscience competencies will be incorporated into a revised Basic Program of Vocational Agriculture in Louisiana (Bulletin 1690, Vols. I, II, and III).

Specific objectives of this research project were:

1. To identify emerging science concepts and competencies in animal science.
2. To identify emerging science concepts and competencies in plant science.
3. To identify emerging science concepts and competencies in soil science.

4. To identify emerging science concepts and competencies in agricultural mechanics.

5. To identify emerging science concepts and competencies in pest management.

Procedures

Two advisory committees were used in the research project --a pedagogy advisory committee and a technical agriculture science advisory committee.

The pedagogy advisory committee was composed of ten people involved in vocational agriculture. This committee included:

Dr. David Druckhammer	University of Southwestern Louisiana,
Dr. Terry Ensley	Louisiana Tech,
Dr. Carey Ford	Southern University,
Mr. Robert Simmons	State Department of Education,
Mr. Gus Miller	State Department of Education,
Mr. Don Gill	Denham Springs High School,
Mr. Jerry Dosher	Oak Grove High School,
Mr. Randy Johnson	Rayne High School,
Mr. Lawrence St. Blanc	Centerville High School, and
Mr. Bob Graham	North DeSoto High School.

The pedagogy advisory committee provided suggestions for implementation of the project, assisted with designing the data collection procedures, served as liaison with agricultural scientists at various universities, assisted with verifying and interpreting the findings, and provided suggestions for incorporating the findings into the state curriculum guide.

The technical agriculture science advisory committee was composed of six agricultural scientists from the Louisiana

Agricultural Center. The committee consisted of the following individuals:

Animal Science - Dr. Paul Humes,
Plant Science - Dr. Donald Robinson,
Agricultural Engineering - Dr. Frederick Sistler,
Plant Pathology -Dr. Milton Rush,
Entomology - Dr. Tom Riley, and
Agriculture Center Administration - Dr. William Brown.

The technical advisory committee assisted with designing the data collection procedures, served as liaison with agricultural scientists in their areas of specialty, assisted with collecting the data, and assisted with verifying and interpreting the findings.

Agricultural scientists in the Louisiana Agricultural Center identified the new and emerging agriscience concepts and competencies through the use of a modified Delphi procedure. After the agriscience competency list was developed, agricultural scientists at three other state universities (those with agricultural education programs) reviewed the list of competencies to verify them. The resulting agriscience concepts and competencies will be incorporated into a revised state curriculum guide.

Summary and Conclusions

The original lists of competencies from the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690 are found in Appendix A. The amended competency lists are presented in Appendix B.

The majority of the emerging science competencies identified were in the areas of plant science and animal science. Animal science was completely reorganized with greater emphasis on breeding systems and reproduction. An instructional unit on anatomy and physiology was added. Less emphasis was placed on judging, selection and animal breeds. It was felt that usage types were more important to the agricultural scientist than specific breeds.

Plant science was expanded to include reproduction and genetics. Lessons were added in the areas of plant physiology, plant classification, and fertilizer usage. Science related topics such as plant nutrition and environmental factors were given greater emphasis. Lessons on nonagronomic careers were added to increase student awareness of the economic impact of plant science beyond the production of row crops.

The topics in soil science remained essentially the same. However, changes were made to increase the emphasis placed upon the biological and chemical properties of the soil. Other areas which were expanded included soil conservation and soil water. Emphasis on factors affecting productivity of the soil and quality of soil water were included.

In agricultural mechanics, the lessons related to tool fitting were removed. Emphasis was placed on why processes occur or machines work more than the mere facts or steps of occurrence.

Entomology was separated out as an individual unit of instruction. Previously, some entomology information had been included in several other units. A lesson on integrated pest management (IPM) was included to introduce students to nonchemical techniques being developed to control insects and their damage. Newer technologies call for a decreased dependence upon chemical controls and increased use of biological, mechanical and cultural techniques in pest management.

The revised competency list incorporates competencies related to the newest science and technological changes in agriculture as identified by agricultural scientists at Louisiana State University and other universities in the state. A curriculum based upon this revised list of competencies would strengthen the science knowledge and abilities of secondary vocational agriculture students. It would also help prepare students for futures in the highly technical and science oriented agriculture of today and tomorrow.

APPENDIX A

Competency Lists From the

Basic Program of Vocational Agriculture in Louisiana

Bulletin 1690

Animal Science

The following competencies are contained in the animal science unit of the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and were reviewed by the technical agriculture science advisory committee. Emerging science-related agricultural objectives were then identified by the advisory committee.

Lesson: Types, Breeds, and Origins of Livestock and Poultry Predominant in Louisiana

1. Identify and define new terms.
2. Identify and describe the major breeds of beef cattle, dairy cattle, sheep, swine, horses, and poultry.
3. Name the popular breeds, if any, in the local area.

Lesson: Parts of Livestock and Poultry

4. Identify by name the various parts of livestock and poultry.
5. Identify by location the various parts of livestock and poultry.

Lesson: Classes and Grades of Livestock and Poultry

6. Define market class and market grade.
7. Outline the sex classes of livestock and poultry.
8. List the market classes and grades for meat animals and the USDA grades of meats.
9. Identify the uses made of market classes and grades.
10. List the factors determining market grades.

Lesson: Selecting and Judging Beef Cattle

11. Identify and define new terms.
12. List and discuss four methods of selection.
13. Identify desirable and undesirable beef animal characteristics.
14. Identify the wholesale cuts of beef.
15. Describe the procedure a judge uses in examining a beef animal.
16. Participate in selection exercises.

Lesson: Selecting and Judging Dairy Cattle

17. Define new terms.
18. Identify factors to consider in selecting individual animals.
19. Identify and describe the unified score card for dairy cattle.

20. Relate pedigree and production testing with dairy cattle selection.
21. State reasons for placings of a class of dairy cattle.

Lesson: Selecting and Judging Swine

22. Identify new terms.
23. Identify primal cuts.
24. Describe the ideal animal.
25. List production record programs.
26. List the traits of quality breeding stock.

Lesson: Selecting and Judging Poultry

27. Identify new terms.
28. List the types of poultry producers.
29. Identify the factors to consider in culling laying hens.
30. Identify the factors for evaluating hens based on present and past egg production.
31. Identify factors to consider for selecting broiler market qualities.

Lesson: Selecting and Judging Sheep

32. Define new terms.
33. List four purposes for which sheep are selected.
34. Explain selection based on conformation.
35. Describe selection based on production records.
36. Discuss selection based on pedigree.
37. Outline a procedure for judging sheep.
38. Determine animal's age by teeth.

Lesson: Selecting and Judging Horses

39. Define new terms.
40. List factors of correct form.
41. Describe correct legs, feet, and pasterns.
42. Define action.
43. Name common conformation defects affecting soundness.
44. Identify other means of selection.

    a) Pedigree
    b) Performance
    c) Disposition and intelligence

Lesson: Fitting and Showing Livestock

45. Define new terms.
46. List advantages of showing livestock.
47. Identify factors for consideration in selecting show animals.

48. Identify the feeding, grooming, and training of selected livestock classes.
49. Identify the health and vaccination requirements for selected livestock classes.

Lesson: Types of Livestock and Poultry Diseases and Methods of Control

50. Define new terms.
51. List signs of good health.
52. List signs of ill health.
53. Identify causes of disease.
54. List factors for a general program of animal health and disease prevention.

Lesson: Types and Control of Livestock Parasites

55. Define new terms.
56. Outline the classification of parasites.
57. List the general symptoms of heavily parasitized animals.
58. Identify the principles involved in the control of common parasites.
59. List methods of controlling parasites.

Lesson: Classification and Functions of Nutrients

60. Define new terms.
61. List the six classes of nutrients.
62. Identify the function of nutrients.
63. Identify and discuss the functions of feed additives.

Lesson: Sources of Nutrients

64. Define new terms.
65. Outline the classification and nomenclature of feedstuffs.
66. Identify the sources of feedstuffs available representing the six essential nutrients for a feeding program.
67. State the economic importance of feeds for livestock.

Lesson: The Digestive Process

68. Define new terms.
69. Label and define essential parts of the digestive system (ruminants, non-ruminants, and poultry).
70. Trace the pathway of feed for the various digestive systems.
71. Discuss the digestion of carbohydrates, fats, and proteins.

Lesson: Preparations of Rations

72. Define new terms.
73. Identify points to consider before attempting to balance a ration.
74. List the steps in ration formulation.
75. Identify the methods of formulating rations.
76. Use the Square Method to balance a ration.

Lesson: Reproduction of Livestock and Poultry

77. Define new terms.
78. List anatomy and functions for the male and female reproductive systems (mammals and poultry).
79. Describe the reproductive process for mammals; for poultry. (Includes estrus, ovulation, fertilization, gestation.)
80. Identify causes for reproductive failures.
81. Compare reproduction in poultry with animals.
82. List the advantages and disadvantages of artificial insemination.

Lesson: Methods of Breeding Livestock

83. List and define the systems of breeding.
84. Identify factors to consider when selecting a system of breeding.
85. Consider the advantages and disadvantages of various systems of breeding.

Plant Science

The following competencies are contained in the plant science unit of the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and were reviewed by the technical agriculture science advisory committee. Emerging science-related agricultural objectives were then identified by the advisory committee.

Lesson: Structure and Physiology of Plants

1. Define new plant science terms.
2. List the top ten money crops in Louisiana.
3. List four reasons why plants are of physical importance.
4. List the parts of the plant and identify their functions.

Lesson: Plant Nutrition

5. Define new plant science terms.
6. Identify the three primary elements and their functions in plant growth.
7. Identify different conditions of the plant when various amounts of fertilizer are lacking.

Lesson: Environmental Factors Affecting Plants

8. Define new terms related to growth processes.
9. Describe components of the plant's underground environment.
10. Describe components of the plant's aboveground environment.
11. List some warm and cool season crops.
12. List optimum growth conditions for different types of plants.

Lesson: Propagation

13. Define new terms related to propagation.
14. Describe differences between sexual and asexual propagation.
15. List examples of dicot plants and monocot plants.
16. List characteristics of good seeds.
17. Propagate plants by seeds, cuttings, separation, and division.

Lesson: Weed Control

18. Define new terms related to weed control.
19. List ways weeds spread.
20. List and discuss reasons weeds are harmful.
21. List methods of weed control.

22. Identify safety precautions to be used when applying herbicides.
23. Apply herbicide to garden project.

Lesson: Moisture Control

24. Define new terms related to moisture control.
25. List three methods of moisture control.
26. List and explain the cultural practices used in moisture control.
27. Describe importance of drainage to crops.
28. Describe importance of irrigation to crops.
29. Describe the three methods of irrigation.
30. Apply moisture control to garden project.

Lesson: Improvement of Plants for Quality Seed Selections

31. Define new terms related to seed and plant selection.
32. Describe the history of crop improvement.
33. List major aims of plant breeders.
34. List and describe three methods of crop improvement.
35. Identify state agency responsible for seed certification in Louisiana.
36. Name major points to consider when selecting varieties for planting.

Lesson: Types of Plant Diseases; Their Transmission, and How They Affect Plants

37. Define new terms related to diseases affecting plants.
38. Name five major causes of plant diseases.
39. Recognize and describe the symptoms and effects of major diseases on plants.
40. Name several methods by which diseases are transmitted in plants.

Lesson: Control of Plant Diseases

41. Define terms related to control of plant diseases.
42. List and describe cultural practices that may be used to prevent plant diseases.
43. List methods of disease control with chemicals.

Soil Science

The following competencies are contained in the soil science unit of the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and were reviewed by the technical agriculture science advisory committee. Emerging science-related agricultural objectives were then identified by the advisory committee.

Lesson: Definition of Soil

1. Define soil.
2. Distinguish between surface soil and subsoil.
3. Identify the six main soil areas in Louisiana and their uses.
4. Describe a soil profile.
5. Identify the various soil horizons in a soil profile.

Lesson: Composition of Soil: Sources and Contents

6. List the four main components found in a normal soil.
7. Explain the composition of the solid part of the soil.
8. Describe the two main sources of organic matter.
9. Name the approximate percentage in which each of the soil properties is found in a normal soil.
10. Differentiate between
    a) A soil low in organic matter, and
    b) A soil high in organic matter.
11. Explain the value of each soil component with regard to the proper growth of the plant.

Lesson: Factors Affecting Soil Formation

12. Describe soil formation.
13. List the factors responsible for soil formation.
14. Name the factors that exert the most influence on soil formation.
15. List the forms of plant life found in poor soil conditions.

Lesson: Physical Properties of Soil

16. Interpret the organic matter content of the surface soil using soil color.
17. Interpret internal drainage of the subsoil by observing soil color.
18. Distinguish between "light" and "heavy" soils.
19. Determine the texture of a soil sample.
20. Classify soil samples using the textural triangle as a guide.
21. Explain the effects of soil structure on productivity.

Lesson: Chemical and Biological Properties of the Soil

22. List the chemical and biological properties of soils.
23. Explain how chemical and/or biological properties affect each other and how they affect the nature and conditions of the soil.
24. Name the microorganisms that are found in the soil.
25. List the soil microorganisms that are beneficial to farmers.
26. Describe the role of higher forms of plant and animal life in the soil.
27. Explain the effect of cation-exchange capacity on plant production.

Lesson: Soil Acidity and Alkalinity

28. Make a large chart of the pH scale to show degrees of soil acidity and alkalinity.
29. Make laboratory tests for acidity of common products such as fresh milk, sour milk, orange juice, and lemon juice. (Transparency III-1-A)
30. Explain how calcium affects soil acidity and the availability of other elements.
31. Explain how pH symbols are used in denoting the degree of acidity and alkalinity in soils.
32. Describe the conditions that lead to soil acidity or alkalinity.
33. List the pH ranges of the major crops.

Lesson: Learning to Correct Soil Acidity

34. List some of the benefits obtained from liming a soil.
35. List the steps involved in liming acid soils used for growing plants.
36. Explain how lime reduces soil acidity.
37. Describe briefly how you would determine the lime requirement for a specific crop.
38. Identify different kinds of lime materials.
39. Describe the appearance of plants growing in soils of different pH levels.
40. List some of the sources of commercial lime.
41. Describe the different methods of applying lime and the type of equipment used.
42. Formulate a liming schedule for various crops.

Lesson: Soil Classifications and Land Use Evaluation

43. List the physical features of land and soil necessary for classifying land.
44. Explain the characteristics of each of the land classes.
45. List the different land classes.
46. Explain how land capability classes are recorded for use.

47. Select the equipment that is needed to classify soils.
48. State the management practices that should be followed to obtain maximum yields and proper soil conservation.
49. Distinguish between the different soil structures and textures.
50. Determine the best possible use of land according to the soil depth, texture, permeability, slope, surface drainage, and degree of erosion.
51. Determine the specific treatment of land.
52. Determine the criteria which can be used in the classification of land for agriculture.
53. Name two kinds of water erosion.
54. Explain why soil erosion is so important to farmers.
55. Name the factors that influence erosion and discuss each as it relates to soil erosion.
56. Evaluate what crops grow best on the different soil types.

Lesson: Nutrient Requirements of Plants

57. Identify the three groups into which the nutrient requirements of plants may be divided. Give examples of each type.
58. List the influence of nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur.
59. Identify and/or describe the deficiency symptoms caused by a lack of nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur.

Lesson: Organic and Inorganic Fertilizers

60. List some sources of inorganic fertilizers.
61. List some sources of organic fertilizers.
62. List the main plant nutrients supplied by inorganic and organic fertilizers.
63. Compare the advantages and disadvantages of organic and inorganic fertilizers.
64. Give an example of a multinutrient fertilizer.
65. Explain how plants obtain carbon, oxygen, hydrogen, nitrogen, phosphorus, and potassium.
66. Differentiate between a fertilizer grade and a fertilizer analysis.
67. Explain the fertilizer ratio of a 5-10-5 grade.
68. Explain where most of the nitrogen in the soil is derived.
69. Describe the nitrogen cycle.
70. Explain where the energy comes from to carry out the nitrogen transformations.
71. Name one common type of bacteria that is involved in the nitrogen cycle.

72. Discuss the symbiotic relationship between bacteria and plants.
73. Specify where the bacteria are located in the root of the plants.
74. Discuss nitrogen fixation.

Lesson: Application of Fertilizers

75. Explain the economic factors a farmer should take into consideration in buying fertilizers.
76. Give the methods of applying solid and liquid fertilizers.
77. Explain the purpose of the different placements of fertilizer in the soil and the relation these placements have to the seed and the growing plant.
78. List the ways fertilizer benefits crop production.

Lesson: Classification -- Gravitational, Capillary, Hygroscopic, and Water Holding Capacity of the Soil

79. Demonstrate the water-holding capacities of sandy and clayey soils.
80. Determine soil water availability.
81. List ways available water can be lost by soils.
82. Name the factors important in determining water movement in the soil.
83. Outline the main purpose of water conservation.
84. Describe how strip cropping can contribute to the conservation of soil water.
85. Name and describe two types of mulch.
86. Explain how production techniques influence the efficiency with which water is utilized by plants.

Lesson: Conducting Soil Judging Contest

87. Define soil.
88. Describe how soils are developed.
89. Identify soil layers.
90. List how soils are classified and named.
91. List and explain the factors to consider in developing soil conservation plans.
92. Complete the Louisiana FFA soil judging scorecard.

Agricultural Mechanics

The following competencies are contained in the agricultural mechanics unit of the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and were reviewed by the technical agriculture science advisory committee. Emerging science-related agricultural objectives were then identified by the advisory committee.

Lesson: Introduction to Agricultural Mechanics, the Use of References, and Field Trips to the Shop Program

1. Define agricultural mechanics.
2. Discuss the relationship between food and fiber and agricultural machinery.
3. Explain why agricultural machinery is becoming more highly sophisticated.
4. List six reasons for having mechanical knowledge and skills.
5. List the areas of concern in agricultural mechanics.
6. Discuss the different types of jobs in the field of agricultural mechanics.
7. Discuss the relationship between agricultural mechanics and one's supervised occupational experience programs.
8. List the individual areas of study in an agricultural mechanics program.
9. Describe the importance of agricultural mechanics in developing mechanical skills.

Lesson: Safety Measures

10. Explain the importance of shop safety rules and regulations.
11. Demonstrate safety awareness by conducting a hazard hunt.
12. Explain how to prepare for safety before entering the work area.
13. Discuss how to prepare for safety on entering the work area.
14. Describe safety practices at the work station.
15. Identify the meaning of various colors used in color coding a shop.
16. List safety steps to check before leaving the shop at the end of the day.

Lesson: Identification, Care, Storage, and Proper Use of Hand Woodworking Tools

17. Identify common woodworking tools found in the agricultural mechanics shop.
18. Contrast the different types of care and storage of various woodworking tools.

19. Describe how rust may be safely removed from tools.
20. Describe the three rules to remember to get the most out of your tools.
21. List the hand tool safety rules.
22. Demonstrate the proper use of hand planes.
23. Demonstrate the proper use of hand saws.
24. Demonstrate the proper use of wood chisels.
25. Demonstrate the proper use of brace and bit.
26. Demonstrate the proper use of hand drills.
27. Demonstrate the proper use of screwdrivers.
28. Demonstrate the proper use of measuring and marking instruments.

Lesson: Nails, Screws, and Fasteners

29. List and describe types of screws.
30. State the characteristics used to identify screws.
31. Define the term "penny".
32. List and describe common types of nails.
33. Calculate nail length.
34. State the two main purposes for bolts.
35. List and describe common types of bolts.
36. Explain the use of corrugated fasteners and staples.

Lesson: Basic Mathematics in Carpentry

37. Explain the importance of learning basic math skills in carpentry.
38. Describe the divisions of a ruler or tape.
39. Calculate square feet.
40. Explain the importance of understanding angles in project construction.
41. Describe two methods of determining lumber dimension.
42. Explain the need for knowing units of measure for various building materials.

Lesson: Preparing and Using Working Drawings

43. Explain the need for working drawings.
44. List and describe the basic drawing equipment.
45. Demonstrate the proper method of attaching drawing paper to the drawing board.
46. Demonstrate the proper method for laying out the margin and title block on drawing paper.
47. Describe the different weights and uses of lines in drawing.
48. Demonstrate the use of the architect's scale.
49. List and describe the three views of objects.
50. Demonstrate the procedure for dimensioning a drawing of an object.
51. Describe the procedure for reading working drawings.

Lesson: Tools Used in Tool Fitting

52. Define the terms associated with tool fitting.
53. Describe the different types of power grinders.
54. List specifications needed to purchase a grinding wheel.
55. List several types of whetstones.
56. Define the purpose of a template.
57. Name the parts of a file.
58. Name the files most commonly used in tool fitting.
59. Explain the procedure to follow in using a steel.
60. List the safety rules to follow in using the power grinder and the file.

Lesson: Reshaping a Screwdriver

61. Differentiate among standard, Phillips, clutch head, offset, and spiral ratchet screwdrivers.
62. Define correct procedure for determining thickness of a standard screwdriver bit that needs fitting.
63. Describe the procedure for reshaping a standard screwdriver on a grinding wheel.
64. Name the type of grit needed in "63" above.
65. Name the type of file used to reshape a Phillips screwdriver.
66. Describe the procedure and tool used to reshape a clutch head screwdriver.

Lesson: Sharpening a Wood Chisel

67. Define and give the purpose of a wood chisel.
68. Indicate the correct angle of bevel for a wood chisel.
69. Demonstrate the correct procedure to follow in sharpening a wood chisel.
70. Discuss why whetting a wood chisel is important.

Lesson: Sharpening a Mower Blade

71. Name the type of grinding wheel recommended to sharpen a sickle blade.
72. Explain the importance of maintaining a balanced rotary mower blade.
73. List the safety rules to be followed in sharpening a mower blade.
74. Describe the procedure to follow in sharpening knives from a sickle type of blade.
75. Describe the procedure to follow in sharpening a lawn mower blade.

Lesson: Electrical Terms, Equipment, Meter Reading, and Computation of Cost of KW Hours

76. Define the following terms:

a) Electricity
b) Circuit
c) Conductor
d) Insulator
e) Ampere
f) Volt
g) Ohm
h) Watt
i) Kilowatt-hour
j) AC
k) DC

77. Describe how electrical energy moves through a circuit.
78. Name the two basic types of circuits.
79. Identify types of conductors and insulators.
80. Explain how electric current is measured.
81. Explain how resistance to current flow is measured.
82. Explain how electrical pressure is measured.
83. Describe Ohm's Law.
84. Explain how electrical power is measured.
85. Explain how electrical energy is measured.
86. Distinguish between AC and DC currents.
87. Describe the tools used in electrical wiring applications.
88. Differentiate between the two types of electrical meters.

Lesson: Skills Necessary in Practical Wiring

89. Describe the proper procedure for removing the cable sheath.
90. Describe the proper procedure for removing insulation from wires.
91. Define splicing.
92. List the three types of solderless connectors.
93. Define the term "ground".
94. Explain why grounding an electrical circuit is important.
95. Describe how system and circuit grounding is accomplished.
96. Describe two different ways of grounding to a metal box.
97. List several types of receptacles.
98. Demonstrate the procedure to follow in connecting a 120-volt duplex receptacle.
99. Define the term "back-wired receptacles".
100. Describe how switches are related.
101. List the three types of common switches used in house wiring.
102. Demonstrate the procedure to follow in connecting single pole switches under the following conditions:
    a) Switch with switch source.
    b) Switch to one light.

103. Demonstrate the procedure to follow in connecting duplex receptacles under the following condition:
    a) Switch to both halves of the duplex receptacle.
    b) Switch to one half, other half "hot" at all times on a duplex receptacle.
104. List the four basic rules in wiring a three-way switch.
105. Demonstrate the procedure to follow in connecting three-way switches under the following conditions:
    a) Lighting outlet ahead of switches.
    b) Lighting outlet between switches.
    c) Lighting outlet at end of run.
106. Demonstrate the procedure to follow in connecting four-way switches.

Lesson: Power Tool Safety and Operation

107. State general power tool safety rules.
108. List safety rules for each power tool.
109. Identify and label parts of each power tool.
110. Explain the purpose or use of each power tool.
111. Describe the operation of each power tool.

Lesson: Cutting Rafters

112. Define new terms.
113. Explain how a rafter square is used in cutting rafters.
114. Calculate the pitch of a roof.
115. Demonstrate the unit, length, and step-off method of laying out a common rater.
116. State the importance of the cut of a roof.
117. Demonstrate the procedure for rafter ridge allowance and rafter overhang.
118. Demonstrate cutting a bird's mouth in a common rafter.

Lesson: Project Planning

119. List the eight-step procedure for planning a shop project.
120. List the items to be considered when selecting a project.
121. State four reasons for drawing a working plan of the project.
122. List three items to consider in selecting materials for the project.
123. Define a bill of materials.
124. Name the items of information listed on a bill of materials.
125. Define board feet.
126. Calculate board feet.
127. Explain the method for determining lumber cost.
128. Describe the method for pricing shingles.
129. Demonstrate the method for completing a bill of materials.

Lesson: Maintenance, Operation, and Servicing Small Engines

130. List 10 machines and/or pieces of equipment powered by small engines.
131. Describe the two major differences in small engines.
132. List the three basic positions of the crankshaft in small engines.
133. Define a "stroke".
134. List and describe the four strokes of a 4-stroke small engine.
135. List and describe the two strokes of a 2-cycle small engine.
136. Compare a 4-(stroke) cycle and a 2-(stroke) cycle small engine.
137. List four major causes that will shorten the life of small engines.
138. Describe the type of information to be found on a small engine's nameplate.
139. Discuss why it is important to use the proper tools on a small engine.
140. Explain why "racing" or "gunning" the engine is detrimental.
141. Give the maximum ft/min a small engine should operate.
142. Explain why it is unsafe to operate a small engine in a building.
143. Describe the first step to follow if the small engine is not running properly.
144. List the parts on a small engine that should be checked before operation.
145. Explain how to determine if a small engine is a two or four cycle by the compression method.
146. Explain why cleaning a small engine is so important.
147. List the steps to follow in cleaning a small engine.
148. List the three types of air cleaners found on small engines.

Lesson: Fundamentals in Arc Welding

149. Define arc welding.
150. List and describe the equipment that is necessary to arc weld.
151. State the basic safety rules in arc welding.
152. List substances that should be removed from metal before it is welded.
153. List the four basic positions used in arc welding.
154. List the four basic joints used in arc welding.
155. Describe how to start the arc.
156. List the factors in determining the proper current setting of the machine.
157. Describe the sound of a proper arc.
158. Define travel speed.
159. Define a crater.

160. Describe the proper procedure to follow to ensure that a crater, from a previous weld, is filled.
161. State the two procedures used to break the arc.
162. Define lead and work angles.
163. Define multiple pass welds.
164. Describe the advantages of weaving an electrode.
165. Explain the factors to consider in determining electrode selection.
166. List the five main ways that electrodes are classified.
167. Explain the electrode identification system.
168. Contrast fast-freeze, fill-freeze, and fast-fill electrodes.
169. Describe importance of keeping electrodes dry.
170. Describe arc welding difficulties, their causes, and their remedies.

Lesson: Shop Exercises in Arc Welding

171. Demonstrate ability and skills required to strike an arc, start the bead, stop the bead, and to restart the bead.
172. Demonstrate ability and skills required in running a bead in the flat position.
173. Demonstrate ability and skills required in running a bead in the horizontal position.
174. Demonstrate ability and skills required in running a bead in the vertical position:
    a) Vertical down, and
    b) Vertical up.
175. Demonstrate ability and skills required in running a bead in the overhead position.

APPENDIX B

Amended Competency Lists For Inclusion in

Basic Program of Vocational Agriculture in Louisiana

Bulletin 1690

Animal Science

The following competencies are the amended animal science competencies which incorporate some competencies originally found in the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and the emerging science competencies. These competencies were identified by the technical agricultural science advisory committee and confirmed by the pedagogy advisory committee.

Lesson: Anatomy and Physiology of Livestock

a. Draw and list the major parts of a typical animal cell.
b. Compare and contrast animal and plant cells.
c. Discuss the functions of the cell nucleus.
d. Describe the stages of normal cell division.
e. Identify the primary components of the skeletal system of the major livestock types.
f. Be familiar with the voluntary muscle systems.
g. Describe the physiology of voluntary muscles.
h. Explain the anatomy and physiology of involuntary muscles.
i. Recognize the parts of the nervous system.
j. Describe the functions of the various parts of the brain.
k. Discuss the functions of each part of the respiratory system.
l. Describe the anatomy and functions of the circulatory system.
m. Describe the anatomy and functions of the heart.
n. Identify the external parts of each livestock species.

Lesson: Classes and Grades of Livestock and Poultry

a. Define market class and market grade.
b. Outline the sex classes of livestock and poultry.
c. List the market classes and grades for meat animals and the USDA grades of meats.
d. Identify the uses made of market classes and grades.
e. List the factors determining market grades.

Lesson: Pedigrees, and Production Record Evaluation

a. Examine sample pedigrees and production records.
b. Define the terms used on pedigrees and production records.
c. Discuss the limitations of using pedigrees as the sole basis of selection.
d. Explain the information found on various types of performance data sheets.
e. Describe the advantages and disadvantages of progeny testing.

Lesson: Conformational Traits and Soundness Indicators

a. List factors of correct form.
b. Define action.
c. Name common conformation defects affecting soundness.
d. Explain the importance of soundness in domestic farm animals.

Lesson: Judging and Evaluation Procedures

a. Identify the steps to follow in performing visual appraisal of individual animals.
b. Define terms used in selecting the different classes of livestock.
c. Describe the current animal type desired in each of the types of livestock.
d. Contrast the body types of beef and dairy animals.
e. Practice visual selection of animals.

Lesson: Systems of Selection and Breeding of Livestock and Poultry

a. Define the terms grading up, crossbreeding, inbreeding, and linebreeding.
b. List factors to be considered in determining the breeding system to use.
c. Explain the advantages of crossbreeding.
d. Discuss the positive and negative qualities of inbreeding.
e. Describe factors to consider in selecting methods of mating in livestock.
f. Compare reproduction in poultry with mammals.
g. Design a breeding system suitable to the local area.
h. Identify and describe the major breeds of beef cattle and dairy cattle.
i. Compare and contrast the production types of swine, sheep, poultry and horses.
j. Name the popular breeds in the local area.

Lesson: Reproductive Processes for Mammals and Poultry

a. Describe the reproductive process for mammals and poultry (estrus, ovulation, fertilization, gestation).
b. Identify puberty and breeding ages for each species.
c. Discuss purposes and method of estrous synchronization.
d. Identify the advantages of preparing animals for breeding.

Lesson: Anatomy and Physiology of Reproduction

a. Label diagrams of the male and female reproductive systems.
b. Describe the differences between the reproductive systems of the various domestic farm species.

c. Discuss the functions of the female reproductive organs in mammals.
d. Describe the functions of the male reproductive organs in mammals.
e. Describe the anatomy and functions of the female reproductive system in poultry.
f. Describe the anatomy and functions of the male reproductive system in poultry.

Lesson: Breeding Methodology

a. Discuss the principles of inheritance of sex-linked traits.
b. Describe the process used in artificial insemination.
c. Describe the advantages and disadvantages in using artificial insemination.
d. Explain the procedures used in embryo transfer and super ovulation.
e. Identify the advantages and disadvantages of embryo transfer.
f. Discuss the use of natural breeding systems.
g. Describe the advantages and disadvantages in using natural breeding systems.
h. Develop a breeding calendar for one selected livestock species.

Lesson: Classification and Functions of Nutrients

a. Define new terms.
b. List the six classes of nutrients.
c. Identify the functions of the basic nutrient groups.
d. Identify and discuss the functions of feed additives.

Lesson: Sources of Nutrients

a. Outline the classification and nomenclature of feedstuffs.
b. Identify the sources of feedstuffs available representing the six essential nutrients for a feeding program.
c. State the economic importance of feeds for livestock.

Lesson: The Digestive Process

a. Label and define the functions of the essential parts of the digestive system (ruminants, non-ruminants, and poultry).
b. Trace the pathway of feed for the various digestive systems.
c. Discuss the digestion of carbohydrates, fats, and proteins.

Lesson: Ration Formulation for Ruminants and Nonruminants

a. Define new terms.
b. Compare rations for ruminants versus rations for nonruminants.
c. Identify points to consider before attempting to balance a ration.
d. List the steps in ration formulation.
e. Identify the methods of formulating rations.
f. Use the Square Method to balance a ration.
g. Formulate a ration for a ruminant.
h. Formulate a ration for a nonruminant.

Plant Science

The following are the amended plant science competencies which incorporate some competencies originally found in the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and the emerging science competencies. These competencies were identified by the technical agricultural science advisory committee and confirmed by the pedagogy advisory committee.

Lesson: Structure of Plants

a. Define new plant science terms.

1. Environment
2. Photosynthesis
3. Nutrients
4. Root tip
5. Root hairs
6. Transplant
7. Fibrous roots
8. Transpiration
9. Respiration
10. Tap root
11. Pollen
12. Pollination
13. Chloroplast

b. List the parts of the plant and identify their functions including:

seed (embryo, cotyledon, groat)
root (tuber, rhizome, stolon, corm, bulb)
stem (xylem, phloem, pith)
leaf (blade, lobe, cotyledon, auricle, ligule)
meristem (apical, dominant, terminal, auxiliary bud)
flowers (anther, stigma, style, ovary)

c. Compare and contrast dicots and monocots based upon the meristematic locations and the reproductive structures. Name examples of each.
d. Describe the functions of plants (food, feed, fiber, soil, wood, recreation, erosion control, nutrient recycling, medicinal, industrial-dyes, chemicals).
e. Distinguish between perennials, biennials and annuals.
f. Differentiate seed crop versus vegetative crop.
g. Describe the life cycle of a crop plant, from seed to vegetative stage to reproductive stage to seed.
h. Define the terms used to identify plants such as leaf type and arrangement, type of fruiting structures, type of root system, and stem characteristics.
i. Compare organic farming to standard production systems.
j. Describe hydroponic crop production.

Lesson: Physiology of Plants

a. Identify the parts of a plant cell and describe the function of each part.
b. Describe the process of photosynthesis.
c. Describe the function of the chlorophyll molecule.
d. Describe the process of respiration.
e. Write a simplified word and symbol formula of photosynthesis and respiration.
f. List conditions which affect photosynthesis.
g. Compare the processes of photosynthesis and respiration.
h. Explain the process of osmosis.
i. Describe the basic make-up and function of carbohydrates (sugars and starches), lipids (fats and oils) and proteins (structural and enzymatic).

Lesson: Plant Nutrition

a. Define new plant science terms.

1. available nutrients
2. leaching
3. element
4. organic fertilizer
5. inorganic fertilizer

b. Identify the three primary elements and their functions in plant growth.
c. Define green manure crop.
d. Produce nutrient deficiencies by planting an indicator plant such as tomatoes in sand using a nutrient solution to produce nutrient deficiencies (Hoagland's solution is an example).
e. Discuss the relationship of adequate fertilization to yields, tillering in grain crops, and return on investment in crop production.
f. Describe purpose of inoculation of legume seeds with nitrogen fixing organisms.
g. Explain minimum, optimum and luxury consumption of soil nutrients by the plant.
h. Compare nutrients from soil versus what plants get from air and water.

Lesson: Fertilizers and Plants

a. Identify the micronutrients needed in plants and learn their chemical symbol.
b. Identify deficiencies caused by the lack of the minor elements.
c. Explain the difference between organic and inorganic fertilizer.

d. Describe the advantages and disadvantages of organic versus inorganic fertilizers.
e. Identify global uses of inorganic and organic fertilizers.
f. Describe the pollution hazards associated with over fertilization.
g. Describe the latest techniques used to dispense only required amounts of fertilizer for crops.

Lesson: Environmental Factors Affecting Plants

a. Define new terms related to growth processes.

1. optimum
2. organic matter
3. aerate
4. retention
5. media or medium
6. source
7. partitioning
8. hormones
9. determinate
10. indeterminate
11. germination
12. growth
13. reproduction
14. environmental effects
15. photoperiod
16. heat units
17. vernalization

b. Describe external influences on plant growth.
c. Explain photoperiodism and dormancy in plants.
d. Describe the affects of plant hormones (auxins, gibberellins, and cytokinins) on plant growth.
e. Explain the commercial uses of auxins.
f. Describe the various tropic responses.
g. Explain the cause of gnostic movement.
h. List some warm and cool season crops.
i. List optimum growth conditions for different types of plants.
j. Describe how crops may be managed to maximize environmental resources (i.e. establishing crop canopies to intercept 100% of light energy prior to fruiting, planting at a date that ensures sufficient biomass to attain maximum yield, etc.).
k. Describe the influence of day length on plant growth.
l. Explain how the cycle of the seasons influences plant growth.
m. Identify how planting date, row spacing, and plant population affect crop yield and quality.

Lesson: Improvement of Plants for Quality Seed Selection

a. Define new terms related to seed and plant selection.

1. heredity
2. genetics
3. inbreeding
4. crossing
5. progeny
6. self fertilization
7. cross fertilization
8. mutation
9. hybrid
10. systemic pesticide
11. toxic
12. vigor

b. Discuss seed development, morphology and composition.
c. List the characteristics of good seeds.
d. Describe the factors which create poor seed quality.
e. Describe the history of crop improvement.
f. List major aims of plant breeders.
g. List and describe three methods of crop improvement.
h. Identify state agency responsible for seed certification in Louisiana.
i. Describe major points and economic aspects to consider when selecting varieties for planting.
j. Explain the danger of monogenetic type crops (i.e., southern corn blight).
k. Describe the possible impact of genetic engineering.
l. Describe breeding for pest resistance (insects, nematodes, and diseases).
m. Describe the classes of seed (i.e. Breeders, Registered, Certified).
n. Distinguish the difference between hybrid seed and seed from open pollinated or self-fed plants.
o. Explain how a "hard seed coat" can be used to maintain high quality seed.
p. Explain why plant breeding takes several years.
q. Discuss why breeders have to constantly be developing improved varieties.

Lesson: Weed Control

a. Define new terms related to weed control.

1. weed
2. annual
3. biennial
4. perennial
5. vegetative propagation
6. selective herbicide
7. non-selective herbicide
8. calibrate
9. drift
10. surfactant

b. List ways weeds spread.
c. List and discuss reasons weeds are harmful.
d. List methods of weed control.
e. Identify safety precautions to be used when applying herbicides.
f. Apply herbicide to garden project.

g. Describe possible applications of genetic engineering and gene splicing to weed control.
h. Explain how a spray system works (pump, pressure regulator).
i. Practice calibration of a spray rig.
l. Explain how herbicides kill weeds.
m. Explain why some herbicides are applied before or after a crop is planted.
n. Discuss why weed problems depend on when they occur during growing season of crop.
o. Identify the major weed species in Louisiana and discuss the options available for controlling each.

Lesson: Moisture Control

a. Define new terms related to moisture control.

1. irrigation
2. mulch
3. organic matter
4. run-off
5. seepage
6. subsoiling
7. tillage

b. List three methods of moisture control.
c. List and explain the cultural practices used in moisture control (annually and at planting).
d. Describe importance of internal and external drainage in soils for crop production.
e. Describe importance of irrigation to crops.
f. Describe the four methods of irrigation (drip, furrow, sprinkler, flood).
g. Create an irrigation experiment on a garden project.
h. Explain the seven unique properties of water.
i. Describe the world's water supply by volume and then percent useable.
j. Explain the hydrologic cycle us.ng the terms surface water, runoff, ground water, water table and aquifer.
k. Explain how irrigation causes salinity problems.
l. Describe several regions of the world where salinity has stopped entirely or decreased crop production.
m. Explain salt water intrusion in irrigation wells.
n. Describe desalination possibilities for irrigation water.
o. Explain subsidence caused by removal of irrigation water.
p. Describe eleven methods used to reduce irrigation water loss.
q. Explain the use of tensiometers and moisture meters.
r. Describe the idea of permaculture.
s. Explain irrigation scheduling.

Lesson: System Used to Classify Plants

a. Describe the classification system of living things according to the Kingdoms of Monera (Prokaryotic Cells), Protista (Eukaryotic Cells), Animalia, and Plantae.
b. Describe the different levels of classification within the plant kingdom.
c. Explain the differences in the classes Gymnospermae and Angiospermae.
d. Explain Carolus Linnaeus' binomial system of classification for genus and species.
e. Define species and explain the agricultural significance of the term in plant breeding.

Lesson: Applied Agricultural Genetics

a. Describe Mendel's work with garden peas.
b. Define:

1. chromosome
2. gene
3. DNA
4. RNA
5. genotypes
6. phenotypes
7. heterozygous
8. homozygous
9. alleles
10. hybrid
11. inbreeding
12. hybrid vigor
13. polyploidy
14. molecular biology
15. genetic engineering
16. genes
17. sexual crossing
18. genome
19. vectors
20. gene transfer
21. natural selection
22. artificial selection
23. heredity
24. chromosomes
25. gene-splicing
26. gene cloning
27. toxins
28. pathogens
29. biological control

c. Describe mitosis.
d. Describe meiosis.
e. Demonstrate a hybrid using a Punnett Square.
f. Explain incomplete dominance.
g. Explain the cause of mutation.
h. Describe the occurrence of multiple alleles.
i. Explain the importance of mass selection.
j. Describe the contributions of Luther Burbank to applied genetics.
k. Explain the "Green Revolution".
l. Describe the possible impact of genetic engineering to plant improvement.
m. Describe possible application of genetic engineering and gene splicing on pest control.

Lesson: Propagation

a. Define new terms related to propagation.

1. propagation
2. germination
3. hard seed
4. inert matter
5. noxious
6. embryo
7. dicot
8. monocot
9. hilum
10. epicotyl
11. cotyledons
12. endosperm
13. dormant
14. bulb
15. corm
16. tuber
17. tuberous root
18. rhizome
19. stolon
20. tissue culture

b. Compare and contrast sexual and asexual propagation.
c. Propagate plants by seeds, cuttings, separation, and division.
d. Explain seed germination and factors that affect it.
e. Describe mass propagation through tissue culture.
f. Identify some of the pitfalls to avoid in propagating plants.
g. Describe the soil chemical and physical properties that influence seed germination and emergence.
h. Discuss anthroculture and gene splicing as methods for genetic improvement.
i. Define biotechnology as it relates to plant improvement.

Lesson: Insects Affecting Louisiana Row Crops

a. Define new terms related to insects associated with Louisiana row crops.
b. Identify the common insects affecting the major crops in Louisiana.
c. Describe and discuss the life cycle of the common insects affecting the major crops in Louisiana.
d. List methods of insect control and give examples of insecticides used to control the insect pest of each crop.
e. Name examples of early, mid, and late-season insect pests of rice in Louisiana.

Lesson: Types of Plant Diseases; their transmission, and how they affect plants

a. Define new terms related to diseases affecting plants.

1. microorganism
2. pathogens
3. symptoms
4. day length
5. wilt
6. mosaic
7. blight
8. curl
9. dwarfing
10. gall
11. mildew
12. rot
13. smut
14. disease

b. Name five major causes of plant diseases.
c. Recognize and describe the symptoms and effects of the major diseases for each major crop in Louisiana.
d. Name several methods by which diseases are transmitted in plants.
e. Explain biogenesis vs. spontaneous regeneration and Louis Pasteur's work in this area as the father of microbiology.
f. Explain Koch's Postulates and their use in determining primary and secondary pathogens.
g. Explain how fungi attack plants.
h. Describe the typical structure and function of a fungi.
i. Describe the life cycle of wheat rust and potato blight.
j. Explain the difference between a saprophyte and a parasite.
k. Explain how some fungi are helpful to plants.
l. Explain how fungi are classified according to their method of sexual reproduction and are in the Kingdom Protista.
m. Describe how fungi are also grown as food and for medicinal purposes.
n. Explain how bacteria are classified by shape, have no cell nucleus and are in the Kingdom Monera.
o. Explain that bacteria affect their host using exo- or endotoxins.
p. Explain that the tremendous ability of bacteria to reproduce by fission makes them dangerous.
q. Explain how viruses are noncellular pathogens that use the cell's DNA or RNA to reproduce.
r. Explain how viruses are classified by their host.
s. Describe the lytic cycle of a virus.
t. Recognize that nematodes are classified in the Kingdom Protista.
u. Identify environmental conditions that favor or hinder disease development.

Lesson: Control of Plant Diseases

a. Define terms related to control of plant diseases.

1. damping off
2. fumigant
3. fungicide
4. resistance
5. sprays
6. dust
7. volatile
8. crop rotation
9. sanitation

b. Discuss the "disease triangle".
c. List and describe cultural practices that may be used to prevent plant diseases.
d. Discuss the impact of genetic engineering on control of plant disease.
e. Discuss how chemicals control diseases.
f. Describe safety precautions in handling pesticides.
g. Explain how genetic resistance reduces production costs and potential environmental impact from spraying.
h. Explain the economic importance of controlling plant diseases.

Lesson: The Forestry Industry In Louisiana and the South

a. Identify the species of trees that are of economic importance to the state.
b. Define the following terms:

1. forest type
2. forestry
3. habitat
4. silviculture
5. softwoods
6. hardwoods
7. timber stands
8. cone
9. conifer
10. deciduous tree
11. evergreen
12. forest
13. mensuration
14. tract

c. Discuss the concept of multiple use in forest management.
d. Describe the ecological importance of trees.
e. Identify the two types of leaves found on trees.
f. Describe the scope of the commercial forest in the South.
g. Discuss the impact of forestry on the Louisiana economy.

Lesson: The Horticulture Industry in Louisiana

a. Discuss the economical impact of horticulture in Louisiana.
b. Define the six horticultural career clusters.
c. Identify potential careers in each horticultural cluster.
d. Find three horticultural related job advertisements.
e. Explain the role and importance of trade associations.
f. Summarize and present one article from a trade journal on horticulture trends.

Soil Science

The following competencies are the amended soil science competencies which incorporate some competencies originally found in the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and the emerging science competencies. These competencies were identified by the technical agricultural science advisory committee and confirmed by the pedagogy advisory committee.

Lesson: Definition of Soil

a. Define soil.
b. Distinguish between surface soil and subsoil.
c. Identify the seven main soil areas in Louisiana and their uses.
d. Describe a soil profile.
e. Identify the soil horizons in a soil profile.

Lesson: Factors Affecting Soil Formation

a. Describe soil formation.
b. List the factors responsible for soil formation.
c. Distinguish between the three major types of parent material.
c. Name the factors that exert the most influence on soil formation.
d. List the forms of plant life found in poor soil conditions.
e. Describe how different climatic conditions affect soil formation.

Lesson: Composition of Soil: Sources and Contents

a. List the four main components found in a normal soil.
b. Explain the composition of the solid part of the soil.
c. Describe the two main sources of organic matter.
d. Name the approximate percentage in which each of the soil properties is found in a normal soil.
e. Differentiate between
   1) A soil low in organic matter, and
   2) A soil high in organic matter.
f. Explain the value of each soil component with regard to the proper growth of the plant.

Lesson: Physical Properties of Soil

a. Interpret the organic matter content of the surface soil using soil color.
b. Interpret internal drainage of the subsoil by observing soil color.

c. Distinguish between "light" and "heavy" soils.
d. Determine the texture of a soil sample.
e. Classify soil samples using the textural triangle as a guide.
f. Explain the effects of soil structure on productivity.
g. Relate why dark color is <u>not always</u> due to organic matter content.
h. Explain the effects of organic matter on soil structure.
i. Describe the effects of soil structure on infiltration, percolation, and the potential for ground water contamination.
j. Discuss how soil type affects crop selection.
k. Compare root restricting boundaries (plow pan, fragipan, etc.)
l. Identify tillage or traffic pans and discuss the factors that contribute to their formation.
m. Describe methods for alleviating traffic pans (e.g. subsoiling, reduced tillage, no-till, etc.)

Lesson: Biological Properties of the Soil

a. List the biological properties of soils.
b. Explain how biological properties affect the nature and conditions of the soil.
c. Name the microorganisms that are found in the soil.
d. List the soil microorganisms that are beneficial to farmers.
e. Describe the role of higher forms of plant and animal life in the soil.
f. Explain the nitrogen cycle.
g. Explain where the energy comes from to carry out the nitrogen transformations.
h. Name one common type of bacteria that is involved in the nitrogen cycle.
i. Discuss the symbiotic relationship between bacteria and plants.
j. Specify where the bacteria are located in the root of the plants.
k. Discuss nitrogen fixation.
l. Identify the roles of different types of bacteria in nitrogen fixation.
m. Describe the concept of mineralization and immobilization of plant nutrients by soil microorganisms.
n. Explain the biological effects on soils when amended with fertilizers, pesticides, and recyclable materials such as municipal wastes.
o. Describe the effects of poor drainage or waterlogging on soil properties and plant growth.

Lesson: Chemical Properties of Soil

a. List the chemical properties of soil.
b. Explain how chemical properties affect the biological properties of soil and the nature and conditions of the soil.
c. Explain the effect of cation-exchange capacity on plant production.
d. Explain the chemical effects on soils when amended with fertilizers, pesticides, and recyclable materials such as municipal wastes.
d. Describe the effect of sand, silt, and clay content on water and nutrient holding ability of soils (CEC).
e. Explain how charges on clay particles affect nutrient retention.
f. Compare different types of clay to soil nutrient availability.

Lesson: Soil Acidity and Alkalinity

a. Make a large chart of the pH scale to show degrees of soil acidity and alkalinity.
b. Make laboratory tests for acidity of common products such as fresh milk, sour milk, orange juice, and lemon juice. (Transparency III-1-A)
c. Explain how calcium affects soil acidity and the availability of other elements.
d. Explain how pH symbols are used in denoting the degree of acidity and alkalinity in soils.
e. Describe the conditions that lead to soil acidity or alkalinity.
f. List the pH ranges of the major crops.
g. Define pH.
i. Explain how soil acidity or basicity is corrected.
j. Discuss how soil pH affects the availability of nutrients which may result in nutrient deficiency or toxicity.

Lesson: Liming to Correct Soil Acidity

a. List some of the benefits obtained from liming a soil.
b. List the steps involved in liming acid soils used for growing plants.
c. Explain how lime reduces soil acidity.
d. Describe briefly how you would determine the lime requirement for a specific crop.
e. Identify different kinds of lime materials.
f. Describe the appearance of plants growing in soils of different pH levels.
g. List some of the sources of commercial lime.
h. Describe the different methods of applying lime and the type of equipment used.
i. Formulate a liming schedule for various crops.

j. Explain the effect of soil acidity on soil structure, water infiltration and soil aggregation.
k. List some of the problems and effects associated with over liming a soil.
l. Describe how lime particle size affects its ability to reduce soil acidity.
m. List several materials that can be used to increase soil acidity or lower the pH.
n. Define dolomite limestone and calcitic limestone.

Lesson: Nutrient Requirements of Plants

a. Review the three groups into which the nutrient requirements of plants may be divided. Give examples of each type.
b. Describe the interactions of nutrient availability levels on nutrient toxicity and deficiency.
c. Identify the toxicity symptoms caused by excessive manganese and aluminum.
d. Identify the major sources of N, P, K, S, Ca, and Mg in soils.
e. Discuss the factors that influence the availability of these nutrients in soils.
f. Describe how soil Ph affects nutrient availability.
g. Relate how different methods of determining nutrient needs of plants interact for more accurate testing.
h. Take a soil sample using correct procedures.
i. Explain how different types of root systems affect plant nutrient uptake.

Lesson: Organic and Inorganic Fertilizers

a. List some sources of inorganic fertilizers.
b. List some sources of organic fertilizers.
c. List the main plant nutrients supplied by inorganic and organic fertilizers.
d. Give an example of a multinutrient fertilizer.
e. Explain how plants obtain carbon, oxygen, hydrogen, nitrogen, phosphorus, and potassium.
f. Differentiate between a fertilizer grade and a fertilizer analysis.
h. Explain the fertilizer ratio of a 5-10-5 grade.
i. Explain where most of the nitrogen in the soil is derived.
j. Describe the advantages and disadvantages of dry versus liquid fertilizer.
k. Explain the advantages of foliar fertilization.
l. Discuss the factors that influence the efficiency of applied fertilizer such as leaching, fixation, etc.

Lesson: Application of Fertilizers

a. Explain the economic factors to consider in buying fertilizers.
b. Give the methods of applying solid and liquid fertilizers.
c. Explain the purpose of the different placements of fertilizer in the soil, and the relation these placements have to the seed and the growing plant.
d. List the ways fertilizer benefits crop production.
e. Describe how fertilizer applications can decrease crop production.
f. Identify possible losses of each major nutrient and their influences on quality of water in lakes and streams, quality of groundwater, and atmospheric quality.
g. Describe and practice calibration of drills in applying fertilizer.

Lesson: Classification of Soil Water

a. Define and describe gravitational, capillary, and hygroscopic water.
b. Demonstrate the water-holding capacities of sandy and clayey soils.
c. Determine soil water availability.
d. List ways available water can be lost by soils.
e. Name the factors important in determining water movement in the soil.
f. Outline the main purpose of water conservation.
g. Describe how strip cropping can contribute to the conservation of soil water.
h. Name and describe two types of mulch.
i. Explain how production techniques influence the efficiency with which water is utilized by plants.
j. Define water holding capacity and how to determine field soil moisture.
k. Explain the effect of texture and structure on field capacity.
l. Discuss responsibilities to ground water quality.
m. Describe the plant, soil, and environmental factors that influence crop responses to irrigation.
n. List several devices or methods used to schedule irrigation to conserve water and maximize crop yields.

Lesson: Soil Classification and Land Use Evaluation

a. List the physical features of land and soil necessary for classifying land.
b. Explain the characteristics of each of the land classes.
c. List the different land classes.
d. Explain how land capability classes are recorded for use.
e. Select the equipment that is needed to classify soils.

f. State the management practices that should be followed to obtain maximum yields and proper soil conservation.
g. Distinguish between the different soil structures and textures.
h. Determine the best possible use of land according to the soil depth, texture, permeability, slope, surface drainage, and degree of erosion.
i. Determine the specific treatment of land.
j. Determine the criteria which can be used in the classification of land for agriculture.
k. Name five kinds of water erosion.
l. Explain why soil erosion is very important.
m. Describe the major types of erosion.
n. Name the factors that influence erosion and discuss each as it relates to soil erosion.
o. Evaluate what crops grow best on the different soil types.
p. Evaluate the effectiveness of erosion prevention procedures.

Lesson: Conducting Soil Judging Contest

a. List and explain the factors to consider in developing soil conservation plans.
b. Complete the Louisiana FFA soil judging scorecard.
c. Recognize general soil map legend.
d. Identify general soil types and uses from a soil survey map.
e. Use a published soil survey to develop a land use plan.

Agricultural Mechanics

The following competencies are the amended agricultural mechanics competencies which incorporate some competencies originally found in the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and the emerging science competencies. These competencies were identified by the technical agricultural science advisory committee and confirmed by the pedagogy advisory committee.

Lesson: Introduction to Agricultural Mechanics, the Use of References, and Field Trips to the Ag Mechanics Lab Program.

a. Define agricultural mechanics.
b. Discuss the relationship between food and fiber and agricultural mechanics.
c. Explain why agricultural machinery is becoming more highly sophisticated.
d. List six reasons for having mechanical knowledge and skills.
e. List the areas of concern in agricultural mechanics.
f. Discuss the different types of jobs in the field of agricultural mechanics.
g. Discuss the relationship between agricultural mechanics and one's supervised occupational experience programs.
h. List the individual areas of study in an agricultural mechanics program.
i. Describe the importance of agricultural mechanics in developing mechanical skills.

Lesson: Safety Measures

a. Explain the importance of lab safety rules and regulations.
b. Demonstrate safety awareness by conducting a hazard hunt.
c. Explain how to prepare for safety before entering the work area.
d. Discuss how to prepare for safety on entering the work area.
e. Describe safety practices at the work station.
f. Identify the meaning of various colors used in color coding a lab.
g. List safety steps to check before leaving the lab at the end of the day.
h. Demonstrate proper use of a fire extinguisher.
i. Explain the chemical process of burning.
j. Demonstrate the role of oxygen in the burning process.

Lesson: Basic Mathematics in Carpentry

a. Explain the importance of learning basic math skills in carpentry.
b. Describe the divisions of a ruler or tape.
c. Calculate square feet.
d. Explain the importance of understanding angles in project construction.
e. Describe two methods of determining lumber dimension.
f. Explain the need for knowing units of measure for various building materials.
g. Measure objects correctly using a ruler, tape or framing square.
h. Measure objects correctly using calipers and micrometers.

Lesson: Identification, Care, Storage, and Proper Use of Hand Woodworking Tools

a. Identify common woodworking tools found in the agricultural mechanics lab.
b. Contrast the different types of care and storage of various woodworking tools.
c. Describe how rust may be safely removed from tools.
d. Describe the three rules to remember to get the most out of your tools.
e. List the handtool safety rules.
f. Demonstrate the proper use of nail hammers.
g. Demonstrate the proper use of hand planes.
h. Demonstrate the proper use of hand saws.
i. Demonstrate the proper use of wood chisels.
j. Demonstrate the proper use of the brace and bit.
k. Demonstrate the proper use of hand drills.
l. Demonstrate the proper use of screwdrivers.
m. Demonstrate the proper use of measuring and marking instruments.
n. Identify the simple machines which are combined to form hand tools.
o. Describe the forces involved in using small handtools.

Lesson: Nails, Screws, and Fasteners

a. List and describe types of screws.
b. State the characteristics used to identify screws.
c. Define the term "penny."
d. List and describe common types of nails.
e. Calculate nail length.
f. State the two main purposes for bolts.
g. List and describe common types of bolts.
h. Explain the use of corrugated fasteners and staples.

Lesson: Preparing and Using Working Drawings

a. Explain the need for working drawings.
b. List and describe the basic drawing equipment.
c. Demonstrate the use of the architect's scale.
d. List and describe the three views of objects.
e. Dimension a drawing of an object.
f. Describe the procedure for reading working drawings.
g. Draw a working plan using graph paper.
h. Develop a working bill of materials for a project.

Lesson: Construct a Skill Project

a. Demonstrate the holding ability of various fasteners.
b. Discuss the ability of various fasteners to withstand stresses, and forces applied to them in joints.
c. Build a woodworking project using as many handtools as possible.

Lesson: Make a Cold Chisel

a. Explain annealing.
b. Describe the chemical processes which occur during the annealing process.
c. Make, shape, and temper a cold chisel.

Lesson: Electrical Terms, Equipment, Meter Reading, and Computation of Cost of KW Hours

a. Define the following terms:

1) Electricity
2) Circuit
3) Conductor
4) Insulator
5) Ampere
6) Volt
7) Ohm
8) Watt
9) Kilowatt-hour
10) AC
11) DC
12) Static Electricity

b. Describe how electrical energy moves through a circuit.
c. Diagram the two basic types of circuits.
d. Distinguish between conductors and insulators.
e. Explain how electric current is measured.
f. Explain how electrical pressure is measured.
g. Explain how resistance to current flow is measured.
h. Describe and apply Ohm's Law.
i. Explain how electrical power is measured.
j. Explain how electrical energy is measured.
k. Distinguish between AC and DC currents.
l. Describe the tools used in electrical wiring applications.
m. Differentiate between the two types of electrical meters.

Lesson: Skills Necessary in Practical Wiring

a. Describe the proper procedure for removing the cable sheath.
b. Describe the proper procedure for removing insulation from wires.
c. Define splicing.
d. List the three types of solderless connectors.
e. Define the term "ground".
f. Explain why grounding an electrical circuit is important.
g. Describe how system and circuit grounding are accomplished.
h. Describe two different ways of grounding to a metal box.
i. List several types of receptacles.
j. Demonstrate the procedure to follow in connecting a 120-volt duplex receptacle.
k. Define the term "back-wired receptacles".
l. Describe how switches are related.
m. List the three types of common switches used in house wiring.
n. Demonstrate the procedure to follow in connecting single pole switches under the following conditions:
    1) Switch with switch source.
    2) Switch to one light.
o. Demonstrate the procedure to follow in connecting duplex receptacles under the following condition:
    1) Switch to both halves of the duplex receptacle.
    2) Switch to one half, other half "hot" at all times on a duplex receptacle.
p. List the four basic rules in wiring a three-way switch.
q. Demonstrate the procedure to follow in connecting three-way switches under the following conditions:
    1) Lighting outlet ahead of switches.
    2) Lighting outlet between switches.
    3) Lighting outlet at end of run.
r. Demonstrate the procedure to follow in connecting four-way switches.

Lesson: Power Tool Safety and Operation

a. State general power tool safety rules.
b. List safety rules for each power tool.
c. Identify and label parts of each power tool.
d. Explain the purpose or use of each power tool.
e. Describe the operation of each power tool.

Lesson: Project Planning

a. List the eight-step procedure for planning a lab project.
b. List the items to be considered when selecting a project.
c. State four reasons for drawing a working plan of the project.

d. List three items to consider in selecting materials for the project.
e. Define a bill of materials.
f. Name the items of information listed on a bill of materials.
g. Define board feet.
h. Calculate board feet.
i. Explain the method for determining lumber cost.
j. Describe the method for pricing shingles.
k. Demonstrate the method for completing a bill of materials.

Lesson: Construction of Projects

a. Draw and plan a woodworking project using power hand tools. Calculate a working bill of materials for the selected project.
b. Construct the project.

Lesson: Operations of Small Gasoline Engines

a. List 10 machines and/or pieces of equipment powered by small engines.
b. Discuss the internal combustion theory.
c. Define a "stroke."
d. Discuss why it is important to use the proper tools on a small engine.
e. Explain why it is unsafe to operate a small engine in a building.
f. Identify the parts and the function of each part of a small gasoline engine.
g. Describe the forces that cause engine wear.
h. Define friction.

Lesson: Operation of a 4-Stroke Engine

a. List the three basic positions of the crankshaft in small engines.
b. List and describe the four strokes of a 4-stroke small engine.
c. List four major causes that will shorten the life of small engines.
d. Describe the type of information to be found on a small engine's nameplate.
e. Explain why "racing" or "gunning" the engine is detrimental.
f. Give the maximum ft/min a small engine should operate.

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Lesson: Operations of the 2-Stroke Engine

a. Describe the two major differences in small engines.
b. List and describe the two strokes of a 2-cycle small engine.
c. Compare a 4-stroke and a 2-stroke engine.

Lesson: Maintenance, Operation, and Servicing

a. Describe the first step to follow if the small engine is not running properly.
b. List the parts on a small engine that should be checked before operation.
c. Explain how to determine if a small engine is a two or four cycle by the compression method.
d. Explain why cleaning a small engine is so important.
e. List the steps to follow in cleaning a small engine.
f. List the three types of air cleaners found on small engines.

Lesson: Fundamentals in Arc Welding

a. Define arc welding.
b. List and describe the equipment that is necessary to arc weld.
c. State the basic safety rules in arc welding.
d. List substances that should be removed from metal before it is welded.
e. List the four basic positions used in arc welding.
f. List the four basic joints used in arc welding.
g. Describe how to start the arc.
h. List the factors in determining the proper current setting of the machine.
i. Describe the sound of a proper arc.
j. Define travel speed.
k. Define a crater.
l. Describe the proper procedure to follow to ensure that a crater, from a previous weld, is filled.
m. State the two procedures used to break the arc.
n. Define lead and work angles.
o. Define multiple pass welds.
p. Describe the advantages of weaving an electrode.
q. Explain the factors to consider in determining electrode selection.
r. List the five main ways that electrodes are classified.
s. Explain the electrode identification system.
t. Contrast fast-freeze, fill-freeze, and fast-fill electrodes.
u. Describe importance of keeping electrodes dry.
v. Describe arc welding difficulties, their causes, and their remedies.

w. Observe the phase change of metals when they are subjected to heat.
x. Describe how materials behave under applied stress.
y. Compare and contrast arc welding, gas metal arc welding, gas tungsten are welding and plasma arc welding.

Lesson: Lab Exercises in Arc Welding

a. Demonstrate ability and skills required to strike an arc, start the bead, stop the bead, and to restart the bead.
b. Demonstrate ability and skills required in running a bead in the flat position.
c. Demonstrate ability and skills required in running a bead in the horizontal position.
d. Demonstrate ability and skills required in running a bead in the vertical position:
   1) Vertical down, and
   2) Vertical up.
e. Demonstrate ability and skills required in running a bead in the overhead position.

Entomology

The following competencies are the entomology competencies which incorporate some competencies originally found in various parts of the Basic Program of Vocational Agriculture in Louisiana, Bulletin 1690, and emerging science competencies. These competencies were identified by the technical agricultural science advisory committee and confirmed by the pedagogy advisory committee. It was recommended that entomology be separated and identified as an individual area of study.

Lesson: Types of Common Insects and Their Life Cycles

a. Define new terms related to insects.

1. appendages
2. abdomen
3. thorax
4. exoskeleton
5. compound eye
6. spiracles
7. molt
8. metamorphosis
9. incomplete metamorphosis
10. complete metamorphosis
11. cocoon
12. larva
13. pupal
14. adult
15. predator
16. maggot
17. nymph

b. Identify beneficial insects and describe how they are helpful.
c. Identify harmful insects and describe how they are destructive.
d. Identify the three body regions of the insect.
e. Identify the types of life cycles of insects.
f. Recognize that insects are classified in the kingdom - Animalia, phylum - Arthropoda, class - Insecta.
g. Recognize that spiders are not insects but are Arthropods and benefit agriculture by eating insects.
h. Describe the differences between insects and spiders.
i. Name the two body parts of a spider.
j. Discuss insect control, biological and chemical methods.
k. Distinguish chewing vs. sucking insects.

Lesson: Concepts and Principles of IPM

a. Explain where IPM has originated.
b. Define IPM.
c. Discuss the importance of IPM.
d. List the six basic elements of an IPM program.
e. List and explain the ten steps necessary to set up an IPM program.
f. List and explain the IPM components for insect pests.
g. Describe methods of sampling and detecting insect pests.

h. Define and explain economic injury levels.
i. Define and explain economic threshold.
j. Explain what is meant by LD50.
k. Discuss five reasons farmers are not using IPM.

Lesson: Identification, Biology and Control of Termites

a. List the three groups of termites found in the U.S.
b. Explain the life cycle of a termite colony.
c. Define caste and explain the termite castes.
d. Differentiate in "Royalty" between termites and honeybees.
e. Explain the three traits which make an insect group social.
f. Explain when termites swarm.
g. Describe the type of destruction various termites are capable of doing.
h. Differentiate between winged ants and termites.
i. List frequent termite damaged areas to look for.
j. List signs of termite infestation.
k. Describe the favorite termite foods.
l. Explain an effective termite prevention program.
m. List chemicals used for termite control.